



Title: Mineral Detection and Content Evaluation Method
Serial No.: 10/064,804
Inventor: Michael Gaft et al.

FIG. 14

Table 1													
Rare-Earth Element Concentration in Florida Apatite													
Determined by Inductively Couple Plasma Method (ICP)													
REE	Ce	Pr	Nd	SM	Eu	Tb	Gd	Dy	Ho	Er	Tm	Er	Yb
Ppm	45	4.5	19	4	1.2	1.0	6	7	1.7	5.6	0.9	5.6	6.8



Title: Mineral Detection and Content Evaluation Method
 Serial No.: 10/064,804
 Inventor: Michael Gaft et al.

FIG. 15

Table 2(a). I_{580}/I_{530} Distinguishing Features in Apatite and Dolomite Under 337 and 355 nm Excitation						
Sampling	Color	Apatite %	Apatite with I_{580}/I_{530} %	Dolomite	Dolomite with I_{580}/I_{530} %	Apatite without I_{580}/I_{530} %
+1/2	white	41	67	59	0	33
	black	100		0		
+3/8	white	52	80	48	7	20
	black	83		17		
+.156	white	63	80	37	0	20
	black	92		8		
+16	white	92	84	8	0	16
	black	100		0		
Kingsford	white	70	81	30	0	19
	black	100		0		
Fort Green	white	83	87	17	0	13
	black	92	9	8		



FIG. 16

Table 2(b). Dy ³⁺ Distinguishing Features in Apatite and Dolomite Under 337 and 355 nm Excitation						
Sampling	Color	Apatite %	Apatite with Dy ³⁺ %	Dolomite	Dolomite with Dy ³⁺ %	Apatite without Dy ³⁺ %
+1/2	white	41	67	59	0	33
	black	100		0		
+3/8	white	52	40	48	0	60
	black	83		17		
+.156	white	63	80	37	0	20
	black	92		8		
+16	white	92	80	8	0	20
	black	100		0		
Kingsford	white	70	56	30	0	44
	black	100		0		
Fort Green	white	83	73	17	0	27
	black	92	9	8		



Title: Mineral Detection and Content Evaluation Method
Serial No.: 10/064,804
Inventor: Michael Gaft et al.

FIG. 17

Table 3. Chemical Analyses of the Products Received by LIBS									
	PITRLS	No. Pebbles	MgO	P ₂ O ₅	BPL	F	Fe ₂ O ₃	Al ₂ O ₃	Insoluble
1	"Bad"	20	2.21	3.48	7.60	0.37	1.11	2.23	70.40
	"Good"	31	0.46	28.61	62.52	3.58	0.74	1.08	12.94
2	"Bad"	18	2.50	5.93	12.96	0.52	1.06	3.84	63.92
	"Good"	33	0.44	28.11	61.42	3.33	0.78	0.75	13.33
3	"Bad"	13	4.6	4.49	9.81	0.3	1.27	2.01	56.46
	"Good"	45	0.34	27.37	59.80	3.42	0.76	1.42	14.24



FIG. 18

Table 4 shows LIBS analysis of the same samples.

Table 4. LIBS Data Using PMP Setup					
Sample		I ₆₀₀	I ₅₂₀	I ₆₀₀ /I ₅₂₀	Mineral
1/2	4	18.2	4.8	3.8	Apatite
1/2	5	6.4	3.2	2	Dolomite
1/2	6	11.6	6.6	1.8	Dolomite
1/2	7	15.6	2.1	7.8	Apatite
1/2	8	8.8	4.2	2.1	Dolomite
1/2	9	14.4	9	1.6	Dolomite
1/2	10	25	4.4	5.7	Apatite
1/2	12	10.6	1.7	6.2	Apatite
1/2	13	15.6	2.1	7.8	Apatite
1/2	14	11	2.5	4.4	Apatite
1/2	15	1.8	0.8	2.3	Apatite
3/8	9	7	4.6	1.5	Dolomite
3/8	10	19.4	3	6.5	Apatite
3/8	11	4.2	4.2	1	Dolomite
3/8	13	4.6	2.3	2	Dolomite
3/8	15	7.5	1.2	6.2	Apatite
3/8	16	11.4	1.4	8.1	Apatite
3/8	17	16	2.2	7.3	Apatite
3/8	18	19	3.6	5.3	Apatite
3/8	19	18	2.4	7.5	Apatite
3/8	20	13	1.6	8.1	Apatite